

MPEP recommends the inclusion of such a section, that such a section is not otherwise specifically required. Therefore, Applicants choose the option of not including the optional section.

Cited References

Thompson et al.

Applicants submit that Thompson et al. uses a backtrack register for the purpose of storing a location to begin scanning a subsequent pixel span, (col. 2, lns. 54-60), and to provide the advantage of reducing the amount of scanning pixels outside the image, (col. 3, lns. 4-5). Thompson et al. states that the "[r]asterization engine 32 calculates a value for each interpolant at various coordinates representing pixel locations in or near the triangle," (col. 4, ln. 67-col. 5, ln. 2), where "[i]nterpolant values ... [include] colors, transparency, texture coordinates, etc. (col. 7, lns. 44-45).

Further, Applicants address steps 54, 56, 72 and 80 as referenced in the Office Action as disclosing Applicants claimed subject matter. Step 52, which includes the calculating of interpolants (colors, transparency, texture coordinates, etc.), is performed prior to and not during or while the step 54 of calculating edge functions at adjacent pixels is performed, (Fig. 3A). Step 56 deals with determining if the pixel behind (the pixel in the opposite direction of the scan direction) the current pixel is within or closer to triangle that the current pixel (Fig. 3A; col. 6, lns. 56-60).

At step 68 (following steps 54 and 56) the present pixel location is set to the next pixel location where the new interpolant values (colors, transparency, texture coordinates, etc.) are then calculated, (Fig. 3B, col. 7, lns. 43-47). Immediately following step 68 is step 72 which includes the calculation of the edge functions for adjacent pixels, (Fig. 3B). As shown in Fig.

3B, the interpolant values are calculated prior to and not during or while step 72 performs edge functions on adjacent pixels, (Fig. 3B).

At step 78 (following steps 54 and 56) the present pixel location is set to the backtrack location and the interpolant values (colors, transparency, texture coordinates, etc.) are calculated for such pixel, (Fig. 3B, col. 8, lns. 18-20). Next, and subsequent to step 78, in step 80, the edge functions are calculated for adjacent pixels, (Fig. 3B). As shown in Fig. 3B, the interpolant values are calculated prior to and not during or while step 80 performs edge functions on adjacent pixels, (Fig. 3B).

Long et al.

Applicants submit that Long et al. is directed to a system for processing graphic objects for alleged fast rasterized rendering. Here, graphics objects are generated by processing edge records using a number of buffers enabling efficient sorting of edge intersections and the subsequent fast processing of image components. (Abstract). As shown in Fig. 3, the "Edge Processing (400)" occurs in the same series of steps (Processing) as the pixel rendering (i.e., "Fill Color Determination (600)," "Pixel Composing Module (700)," and "Pixel Output Module (800)"), and as such where Long et al. refers to "the edge processing module 400 [occurring] during a scan line render operation, Long et al. clearly is referring to a serial relationship between the edge processing module and the scan line render operation," (col. 11, lns. 50-52), therefore such edge functions are not performed while a pixel is being rendered.

Malamy et al.

Malamy et al. is directed to polygon rendering with a dedicated setup engine. More specifically, Malamy et al. discloses a system of rendering polygons using two division operations rather than four. (col. 2, lns. 34-44). Applicants submit that Malamy et al., (Abstract, Fig. 2, Fig. 3, Fig. 4, col 2, lns. 45-54, col 5 lns. 1-5), is absent any reference to Applicants' edge function, as well as being absent any reference to using any look-ahead type functionality to determine whether a next successive pixel will fall outside of a graphic primitive. In contrast, Malamy et al. discloses an edge walker that iterates along the long edge of a triangle determining starting points for successive spans, (col. 3, lns. 45-54). As such, Malamy et al. is not identified as disclosing "edge functions," (claim 3), including, for example, " $E0=(X2-X1)(Y-Y0)-(Y2-Y0)(X-X0)$," " $E1=(Y1-Y0)(X-X0)-(X1-X0)(Y-Y0)$ " and " $E2=(Y2-Y1)(X-X1)-(X2-X1)(Y-Y1)$," (Fig. 3), where such edge functions are used to determine if an x,y coordinates of a given pixel falls within a primitive defined by the corresponding edges, (Spec. pg. 7, lns. 3-6). Therefore, Applicants submit that Malamy et al., does not, either implicitly or explicitly, or when considered alone or in combination with the other cited references, disclose, teach or suggest Applicants' claimed subject matter.

Claims 2, 10 and 14-21

Claims 2, 10 and 14-21 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Thompson et al., in further view of Long et al. Applicants respectfully request reconsideration and withdrawal of these rejections based on the following discussion.

Independent Claim 17

Applicants acknowledge the Office Action's statement that "Thompson et al. does not explicitly disclose that 'scanning a pixel within the primitive while the look-ahead module process the next pixel.'"

Applicants submit that Thompson et al. does not disclose, teach or suggest, Applicants' claim 17 subject matter, that includes, inter alia:

a setup engine that outputs representative values of a graphic primitive; and a raster engine that receives the representative values of the graphic primitive and forms therefrom representative pixels, the raster engine having at least a scan module that scans only pixels within the graphic primitive and assigns data values to each of the pixels and a look-ahead module that identifies pixels that are inside of the primitive; wherein the look-ahead module processes successive pixels one at a time using edge functions to determine whether a next pixel is within the graphic primitive; and wherein the scan module scans a pixel previously identified as being within the graphic primitive while the look-ahead module processes the next pixel,

(claim 17).

Processing Pixels Outside Image Teaches Away

In fact, Applicants submit that Thompson et al. teaches away from Applicants' subject matter where at least Thompson et al. includes the processing of pixels outside the boundaries of the image to generate pixel data regarding the color, transparency, texture coordinates, etc. of such non-image pixels. Thompson et al. states that the "[r]asterization engine 32 calculates a value for each interpolant at various coordinates representing pixel locations ... near the triangle," (col. 4, ln. 67-col. 5, ln. 2), and each "[i]nterpolant value ... [includes] colors, transparency, texture coordinates, etc. (col. 7, lns. 44-45). As such, Thompson et al. requires the processing of current pixel data for a current pixel that is outside (near) a triangle being processed, and therefore does not disclose, teach or suggest, at least, a "scan module ... [that] scans only pixels within the graphic primitive ... wherein the scan module scans a pixel previously identified as being within the graphic primitive ...," claim (17).

Further, Thompson et al. teaches away from Applicants claimed subject matter where the pixels first have their interpolant values calculated, (colors, transparency, texture coordinates, etc.), before identifying that such pixel is actually in the triangle. As shown in Fig. 3A, Thompson et al. discloses the calculating of such interpolant values for a current pixel at step 52

before any determination is made as to the location of a next pixel at steps 54 and 56. Next, in steps 64, 68 and 72, step 64 identifies a pixel that is in or close (i.e., not within) to the triangle, then in step 68 the interpolant values (colors, transparency, texture coordinates, etc.) are calculated for this pixel that may very well be outside the triangle, (col. 7, lns. 43-47). Further, in step 78, where a backtrack location is loaded (where such backtrack location can be a pixel that is merely close to (not within) a triangle – see step 56), and where the present pixel location is set to the backtrack location and the interpolant values (colors, transparency, texture coordinates, etc.) are calculated for such pixel, (col. 8, lns. 18-20), whether or not the pixel is within or without the triangle. Here, the interpolant values are generated before the next step 80 is performed on adjacent pixels thereto.

Edge Functions Performed in Series, Rather Than in Parallel, Teaches Away

Further, to the extent that any of the steps 54, 72 and 80 are performed, where edge functions are used to determine if an adjacent pixel is within or near the triangle, such steps are performed in series, and not in parallel with associated interpolant value generation as found in steps 52, 68 and 78, Thompson et al. teaches away from the “scan module [than] scans a pixel ... while the look-ahead module processes the next pixel.” Applicants note at least one advantage of such claimed subject matter of that disclosed in Thompson et al. as being the “eliminat[ion of] what are referred to as dead cycles, (that is, processing of pixels ... identified by the look ahead module ... as being inside of the primitive ...) and therefore greatly increases the efficiency and speed, as well as reducing circuit complexity,” (Spec. pg. 7, lns. 25-28).

Long et al. Discloses Edge Functions Used in Series, Not While Scanning a Current Pixel

Next, Long et al. does not disclose, teach or suggest the “... the scan[ning of] a pixel previously identified as being within the graphic primitive while [a] look-ahead module

processes [a] next pixel..." (claim 17), but instead simply discloses the use of edge function in series with pixel rendering. As shown in Fig. 3, the "Edge Processing (400)" occurs in the same series of steps (Processing) as the pixel rendering (i.e., "Fill Color Determination (600)," "Pixel Composing Module (700)," and "Pixel Output Module (800)"), and as such where Long et al. refers to "the edge processing module 400 [occurring] during a scan line render operation, Long et al. clearly is referring to a serial relationship between the edge processing module and the scan line render operation," (col. 11, lns. 50-52), therefore such edge functions are not performed while a pixel is being rendered.

Applicants note that in order for prior art references to be combined by obviousness, at a minimum, there must be a suggestion of desirability for the modification. Applicants submit that neither Thompson et al. nor Long et al. suggest a desirability for modification, explicit or otherwise. In addition, there must be a teaching or suggestion to make the combination and a reasonable expectation of success must be both found in the prior art, and not based on Applicants' disclosure. Further, the level of skill in the art cannot be relied upon to provide the suggestion to combine references. Additionally, since none of the cited references teach or suggest a scan module and a look-ahead module where the scan module scans a pixel previously identified as being within the graphics primitive while the look-ahead module process the next pixel, the combination of any of the cited references cannot produce the Applicants' invention as claimed.

Further, Applicants respectfully submit that the Office Action uses improper hindsight reasoning by suggesting it would have been obvious to modify Thompson et al. and/or Long et al. to achieve Applicants' claim 17 subject matter, where the Office Action, using impermissible hindsight, bases such arguments only upon the teaching or suggestion within Applicants' own disclosure. Applicants submit that there must be some suggestion or motivation, either in the

reference itself, or in the knowledge of generally available to one of ordinary skill in the art, to modify the reference as described. Further, to the extent that the Office Action relies on a position that modifications of Thompson et al. and/or Long et al. to meet the claimed invention would have been well within the ordinary skill of the art at the time Applicants' invention was made, because the references, and/or the knowledge of one skilled in the art, were individually known to those of skilled in the art, is not sufficient to establish a prima facie case of obviousness without some objective reason to combine the teachings of the references. Applicants submit that if one of ordinary skill in the art at the time of Applicants' invention were to read Thompson et al. and/or Long et al. such a person would not be in possession of Applicants' claimed subject matter.

Independent Claim 20

Applicants respectfully submit that neither Thompson et al. nor Long et al. disclose, teach or suggest, whether considered alone or in combination, Applicants' claimed subject matter including, inter alia:

“...determining representative values of a graphic primitive; determining, successively, from the representative values of the primitive data values for each pixel of a set of pixels that are inside of the triangle, and, for each current pixel of the set of pixels inside of the triangle, looking ahead to a next adjacent pixel to determined if the next adjacent pixel is inside of the triangle using edge functions; storing a characteristic value for the next adjacent pixel when the next adjacent pixel is inside the triangle; and scanning the current pixel while looking ahead to a next adjacent pixel to determined using edge functions if the next adjacent pixel is inside of the triangle,”

(Claim 20).

Applicants direct the Examiner's attention to the arguments above regarding the allowability of claim 17, and submit for the same or similar reasons, that Applicants' claim 20 is allowable as written.

Independent Claim 21

Applicants respectfully submit that neither Thompson et al. nor Long et al. disclose, teach or suggest, whether considered alone or in combination, Applicants' claimed subject matter including, inter alia:

"...at least one graphic triangular primitive; a first module that generates edge functions for the primitive and that provides indication of which of the edge functions corresponds to a longest side of the triangular primitive, and that provides starting coordinates for the triangular primitive; a second module that forms pixels using the edge functions of the primitive and that provides at least one data value for each pixel; and a third module that, successively, from a successive current pixel, determines if a next pixel is within the triangular primitive, the third module only storing a data value of the next pixel when the next pixel is inside of the triangular primitive,"

(Claim 21).

Applicants direct the Examiner's attention to the arguments above regarding the allowability of claim 17 and 20, and submit for the same or similar reasons, that Applicants' claim 21 is allowable as written.

Dependent Claim 2

Applicants submit that Thompson et al. does not disclose, teach or suggest, Applicants' claim 2 subject matter, that includes, inter alia: "The system according to claim 17, wherein the scan module is structured to perform block mode scanning," (claim 2).

Applicants submit that because claim 2 (dependent claim) depends from claim 17 (parent claim), and as a dependent claim therefrom, the dependent claim is allowable for at least the reasons for which the parent claim is allowable. Applicants further submit that the dependent claim is also allowable in light of the presence of novel and non-obvious elements contained therein that are not otherwise present in the parent claim.

Dependent Claim 10

Applicants submit that Thompson et al. does not disclose, teach or suggest, Applicants' claim 10 subject matter, that includes, inter alia: "The method according to claim 20, wherein the method performs block mode scanning," (claim 10).

Applicants submit that because claim 10 (dependent claim) depends from claim 20 (parent claim), and as a dependent claim therefrom, the dependent claim is allowable for at least the reasons for which the parent claim is allowable. Applicants further submit that the dependent claim is also allowable in light of the presence of novel and non-obvious elements contained therein that are not otherwise present in the parent claim.

Dependent Claim 14

Applicants submit that Thompson et al. does not disclose, teach or suggest, Applicants' claim 14 subject matter, that includes, inter alia: "The system according to claim 21, wherein a data value is assigned to a current pixel within the triangular primitive, and a data value is saved for a next pixel within the triangular primitive only when the next primitive is within the triangular primitive," (claim 14).

Applicants specifically note the specific discussions with respect to claim 17. noting Thompson et al.'s processing of interpolation data for pixels that are located outside the triangle, (i.e., close or near pixels), not just those located inside the triangle.

Applicants submit that because claim 14 (dependent claim) depends from claim 21 (parent claim), and as a dependent claim therefrom, the dependent claim is allowable for at least the reasons for which the parent claim is allowable. Applicants further submit that the dependent claim is also allowable in light of the presence of novel and non-obvious elements contained therein that are not otherwise present in the parent claim.

Dependent Claim 15

Applicants submit that Thompson et al. does not disclose, teach or suggest, Applicants' claim 15 subject matter, that includes, inter alia: "The system according to claim 21, wherein data values are assigned only to pixels within the triangular primitive and never to pixels outside of the triangular primitive," (claim 15).

Applicants specifically note the specific discussions with respect to claim 17 noting Thompson et al's processing of interpolation data for pixels that are located outside the triangle, (i.e., close or near pixels), not just those located inside the triangle.

Applicants submit that because claim 15 (dependent claim) depends from claim 21 (parent claim), and as a dependent claim therefrom, the dependent claim is allowable for at least the reasons for which the parent claim is allowable. Applicants further submit that the dependent claim is also allowable in light of the presence of novel and non-obvious elements contained therein that are not otherwise present in the parent claim.

Dependent Claim 16

Applicants submit that Thompson et al. does not disclose, teach or suggest, Applicants' claim 16 subject matter, that includes, inter alia: "The system according to claim 21, wherein the second module forms a plurality of data values for each pixel," (claim 16).

Applicants submit that because claim 16 (dependent claim) depends from claim 21 (parent claim), and as a dependent claim therefrom, the dependent claim is allowable for at least the reasons for which the parent claim is allowable. Applicants further submit that the dependent claim is also allowable in light of the presence of novel and non-obvious elements contained therein that are not otherwise present in the parent claim.

Dependent Claim 18

Applicants submit that Thompson et al. does not disclose, teach or suggest, Applicants' claim 18 subject matter, that includes, inter alia: "The system according to claim 17, wherein each edge function is associated with one particular edge of the graphic primitive and determines whether or not the next pixel in the horizontal direction is within the graphic primitive with respect to the one particular edge," (claim 18).

Applicants submit that because claim 18 (dependent claim) depends from claim 17 (parent claim), and as a dependent claim therefrom, the dependent claim is allowable for at least the reasons for which the parent claim is allowable. Applicants further submit that the dependent claim is also allowable in light of the presence of novel and non-obvious elements contained therein that are not otherwise present in the parent claim.

Dependent Claim 19

Applicants submit that Thompson et al. does not disclose, teach or suggest, Applicants' claim 19 subject matter, that includes, inter alia: "The system according to claim 18, wherein each edge function returns a positive result if the next pixel is within the graphic primitive with respect to the one particular edge," (claim 19).

Applicants submit that because claim 19 (dependent claim) depends from claim 18 (parent claim), and as a dependent claim therefrom, the dependent claim is allowable for at least the reasons for which the parent claim is allowable. Applicants further submit that the dependent claim is also allowable in light of the presence of novel and non-obvious elements contained therein that are not otherwise present in the parent claim.

Claims 3-5 and 11-12

Claims 3-5 and 11-12 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Thompson et al., an in view of Long et al., and in further view of Malamy et al. Applicants

respectfully request reconsideration and withdrawal of these rejections based on the following discussion.

Dependent Claim 3

Applicants submit that neither Thompson et al. Long et al. nor Malamy et al., when considered alone or in combination disclose, teach or suggest, Applicants' claim 3 subject matter, that includes, inter alia: "The system according to claim 17, wherein the graphic primitive is a triangle, and wherein the representative values are at least one edge function of the triangle and slope values for at least one vertex of the triangle," (claim 3).

Applicants note the Office Actions statement that "Thompson et al. does not explicitly disclose that the representative values are edge function of the triangle or edge function of a longest side of the triangle."

Further, Applicants direct the Examiner's attention to the arguments directed to how Thompson et al. does not disclose, teach or suggest Applicants' claimed subject matter, and submit that for at least such same or similar reasons, Thompson et al. alone, nor Thompson et al. when considered in combination with Long et al. and/or Malamy et al. does not disclose teach or suggest Applicants' claimed subject matter.

Applicants also note, as discussed above, that Malamy et al. is directed to polygon rendering with a dedicated setup engine. More specifically, Malamy et al. discloses a system of rendering polygons using two division operations rather than four. (col. 2, lns. 34-44). Applicants submit that none of the cited language from Malamy et al., (Abstract, Fig. 2, Fig. 3, Fig. 4, col 2, lns. 45-54, col 5 lns. 1-5), contain any reference to Applicants' edge function. In contrast, Malamy et al. discloses an edge walker that iterates along the long edge of a triangle determining starting points for successive spans, (col. 3, lns. 45-54). As such, Malamy et al. is not identified as disclosing "edge functions," (claim 3), including, for example, " $E0=(X2-X1)(Y-$

$Y0)-(Y2-Y0)(X-X0)$,” “ $E1=(Y1-Y0)(X-X0)-(X1-X0)(Y-Y0)$ ” and “ $E2=(Y2-Y1)(X-X1)-(X2-X1)(Y-Y1)$,” (Fig. 3).

Further, Applicants respectfully submit that neither Thompson et al. and Malamy et al. suggest a desirability for modification, explicit or otherwise. Additionally, since none of the cited references disclose, teach or suggest Applicants' claimed subject matter, for example at least that claimed in the claimed subject matter of claim 17, the combination of any of the cited references cannot produce the Applicants' invention as claimed.

In addition, Applicants also submit that, at least, because claim 3 depends from claim 17, and as a dependent claim therefrom, claim 3 is allowable for at least the reasons claim 17 is allowable. Applicants further submit that claim 3 is also allowable in light of the presence of novel and non-obvious elements contained in claim 3 that are not otherwise present in claim 17.

Dependent Claim 4

Applicants direct the Examiner's attention to the arguments above regarding claims 3 and 17. Applicants respectfully submit that, at least in light of such arguments, that neither Thompson et al., Long et al., nor Malamy et al., either implicitly or explicitly, or when considered alone or in combination, disclose, teach or suggest Applicants' claimed subject matter. More specifically regarding claim 17, Applicants submit that, at least, because claim 4 depends from claim 17, and as a dependent claim therefrom, claim 4 is allowable for at least the reasons claim 17 is allowable. Applicants further submit that claim 4 is also allowable in light of the presence of novel and non-obvious elements contained in claim 4 that are not otherwise present in claim 17.

Dependent Claim 5

Applicants direct the Examiner's attention to the arguments above regarding claims 5 and 17. Applicants respectfully submit that, at least in light of such arguments, that neither

Thompson et al., Long et al., nor Malamy et al., either implicitly or explicitly, or when considered alone or in combination, disclose, teach or suggest Applicants' claimed subject matter. More specifically regarding claim 17, Applicants submit that, at least, because claim 5 depends from claim 17, and as a dependent claim therefrom, claim 5 is allowable for at least the reasons claim 17 is allowable. Applicants further submit that claim 5 is also allowable in light of the presence of novel and non-obvious elements contained in claim 5 that are not otherwise present in claim 17.

Dependent Claim 11

Applicants direct the Examiner's attention to the arguments above regarding claims 3 and 20. Applicants respectfully submit, that at least in light of such arguments, that neither Thompson et al., Long et al., nor Malamy et al., either implicitly or explicitly, or when considered alone or in combination, disclose, teach or suggest Applicants' claimed subject matter. More specifically regarding claim 20, Applicants submit that, at least, because claim 11 depends from claim 20, and as a dependent claim therefrom, claim 11 is allowable for at least the reasons claim 20 is allowable. Applicants further submit that claim 11 is also allowable in light of the presence of novel and non-obvious elements contained in claim 11 that are not otherwise present in claim 20.

Dependent Claim 12

Applicants direct the Examiner's attention to the arguments above regarding claims 4 and 20. Applicants respectfully submit, that at least in light of such arguments, that neither Thompson et al., Long et al., nor Malamy et al., either implicitly or explicitly, or when considered alone or in combination, disclose, teach or suggest Applicants' claimed subject matter. Further, regarding claim 20, Applicants submit that, at least, because claim 12 depends from claim 20, and as a dependent claim therefrom, claim 12 is allowable for at least the reasons

claim 20 is allowable. Applicants further submit that claim 12 is also allowable in light of the presence of novel and non-obvious elements contained in claim 12 that are not otherwise present in claim 20.

CONCLUSION

For the foregoing reasons, withdrawal of the rejections and allowance of the claims is respectfully requested. If there are any questions or comments regarding this response, the Examiner is encouraged to contact the undersigned at 312-609-7500.


Respectfully submitted,

Dated:

2/6/04

Vedder, Price, Kaufman & Kammholz
222 North LaSalle Street
Chicago, Illinois 60601
Telephone: (312) 609-7500
Facsimile: (312) 609-5005

By:


Brent A. Boyd
Reg. No. 51,020